INDIGENOUS

MALARIAL DISEASES,

—OF—

WYOMING VALLEY.

Crawford (John B.)

AN ESSAY

ON THE

INDIGENOUS MALARIAL DISEASES

OF WYOMIMG VALLEY,

READ, BY APPOINTMENT, BEFORE

THE LUZERNE COUNTY MEDICAL SOCIETY,

BY

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AT

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The Indigenous Diseases of Wyoming Valley.

The duty was assigned me, at the last meeting of our Society, of opening a discussion to-day upon the subject of our "Endemic Malarial Diseases." The time which has intervened between the last meeting and this has not only been brief, but it has been a period of unusual labor in my ordinary professional duties, and I have therefore had but little opportunity for investigating the subject of this discussion.

The paper which I have now to present is but little more than some rough notes which I have jotted down at brief intervals, and amid frequent interruptions. I regret that I have not been able to give this subject the careful study, and the close, consecutive thought that a matter of so much interest and importance demands. I trust, however, that my own deficiencies will be more than compensated for by the other members who are expected to take part in this discussion.

The air, which was designed for the respiration of the higher forms of animated beings, contains in its pure state:

	Weight.	*Volume.*	
Oxygen,	23,	21.	Specific gravity, 1,000.
Nitrogen,	77,	79.	

A trace of carbonic acid and a varying amount of vapor are always found diffused through the atmosphere, but are not supposed to vitiate it in any degree, or to render it less adapted to the purposes of respiration, or to the maintenance of health. "Bad air," therefore, or "malaria," designates, in its broadest sense, some adulteration or changed condition of the atmosphere, or some admixture of noxious materials therewith, rendering it unsuited to the respiratory requirements of the animal system; or of exciting therein those aberrations of vital function which we call disease.

As this term, "malaria," is generally used by the medical profession, and as it is usually understood, it designates an atmosphere vitiated by the emanations of low, swampy or marshy grounds, produced either by the effluvia of decomposing vegetation, the gaseous exhalations of a marshy soil, or by the minute spores of cryptogamic plants; and the effects of which are seen in the various forms of intermitting, remitting and continued fevers.

On a former occasion I stated to this society my reasons for believing that this form of malaria is produced by the spores of fungiferous vegetation. I need not, therefore, now enter into a discussion of the subject of malarial poisons, or the sources of malarial diseases in the sense that these subjects are generally understood throughout the world, and by the medical profession.

The terms in which my allotted task for to-day is expressed, "Indigenous Malarial Disease," would seem to imply the idea that there is in the atmosphere of our locality some peculiar quality, or material, differing in its nature, and varying in its effects, from the marsh-tainted atmosphere of other malarial districts; that we have around and among us a class of diseases deriving their origin from a vitiated atmosphere, yet differing in respect to the symptoms which they present, or to the poisons that produce them, or in both, from the malarial diseases of other localities.

It will be well, therefore, at the outset of this discussion, to carefully survey the locality in which these peculiarities may be supposed to exist; to take a bird's-eye view of its conformation and surroundings; to observe whatever may serve to exert a deleterious effect upon the health of its inhabitants; and to study those impalpable, yet potent morbific agents that may be engendered by the peculiar conditions that surround us. The city of Wilkes-Barre and its neighboring towns are situated in a valley, or rather basin, closely surrounded by hills, which vary in height from eight hundred to one thousand feet. The bottom of

this basin is, in the main, level; the soil alluvial, in some parts consisting of a coarse gravel, but mainly formed of a sandy loam. A few marshes of small extent are found within its borders, and a limited portion of its surface consists of a clayey loam. A river of considerable size, with a moderate but not sluggish current passes through its longest diameter. Abundant springs of pure water flow (or rather once did flow) to the surface in every portion of the valley. Numerous streams glide down the mountain ravines, and empty their currents into the Susquehanna. Such is, or rather was, the topographical character of Wyoming Valley. Beneath its surface and extending far up on its contiguous mountain sides are rich deposits of anthracite coal. The processes of mining and utilizing this coal, and the industries which have been developed in connection therewith, have wrought extensive and important changes, not only in respect to population, to water supply, and to drainage, but have changed the constituent elements of our atmosphere in many and important respects.

I am informed that previous to the construction of the North Branch Canal and the building of a dam across the Susquehanna River at Nanticoke, ague and remitting fevers and the other forms of miasmatic diseases were unknown in this valley; but that their occurrence immediately followed the construction of these works. For several years subsequently each summer and autumn brought an annual epidemic of chills and fever; and this yearly recurrence of miasmatic disease has been seen in the vicinity of Nanticoke up to the present time. But, as is usually the case, the succeeding cold weather of autumn and winter checked or destroyed the epidemic influence, and a period of comparative healthfulness ensued. The miasm which produces this endemic disease seems to be engendered by the successive flooding and drying of a considerable portion of the soil situated contiguous to the village of Nanticoke, caused by the dam which I have mentioned.

But there are other and more important particulars in

which the salubrity of our atmosphere or our locality have been interfered with. In order to properly estimate these it will be necessary to consider somewhat in detail the sources, the amount, the composition, and the effects of the various gaseous products of anthracite coal, as well as of the various other contaminating agencies affecting not only the air which we breathe, but likewise the water which we drink.

Issuing from various portions of the surface of our valley are streams of carbureted hydrogen. This is evolved in immense quantities in every portion of the coal fields, and is generated in some of our coal mines in quantities so great as to be past computation. I am informed by the Superintendent of one of the coal mines within our city limits, that the quantity of this gas which is being constantly evolved within that mine is so great that, if the appliances for its removal were arrested for the short space of fifteen minutes, the life of every person within the mine would thereby be endangered. This gas consists of:

	Atoms.	*Weight.*	*Volume.*	
Hydrogen,	2,	24.6,	2,	sp. gr. 562.
Carbon,	1,	75.4,	1,	

This gas is most dangerous in consequence of its explosive qualities, and is popularly known as fire damp. It is, of course, unsuited to the purposes of respiration, but is not directly poisonous in its effects. The worst consequences of its inhalation probably result from the adulterated, or rather the diluted, condition of the atmosphere produced by its presence. As its specific gravity is much less than that of air, it becomes speedily dissipated. It is not probable that this substance seriously vitiates the atmosphere, except in the way of rendering it less invigorating, and thus lowering the force of the vital powers.

Within the boundaries of Wyoming Valley there is annually mined about eight million tons of coal. About twenty-five per cent. of this amount, or two million tons, is consumed as wastage, and is piled up in numerous places about the

mines. These culm-heaps, as they are called, have accumulated for many years, and it would be difficult to estimate the amount of this material which exists in almost every portion of the valley. These great mounds, (they sometimes amount almost to mountains,) are now nearly all on fire; and the amount of coal thus undergoing combustion is at least equal to the annual accumulation of refuse, or about two million tons. In addition to this it is estimated that about three hundred and seventy-five thousand tons are annually consumed for domestic, manufacturing and other purposes within the valley. Besides these we should take into account the vast amount of coal undergoing combustion within the mines. I have no means of estimating accurately the amount of coal that is thus consumed, but it has, probably for several years, amounted to considerably more than half a million tons annually. Thus we see that about three million tons of anthracite coal are being yearly consumed within the area which we are considering; and that nearly all of it is undergoing a slow and imperfect combustion. This amounts to about eight thousand and two hundred tons of coal daily consumed in this manner, and of course diffusing its noxious products through the atmosphere.

Besides carbureted hydrogen, the gases evolved by the combustion of anthracite coal are, carbonic acid, sulphureted hydrogen, sulphurous acid, and carbonic oxide.

Carbonic acid is composed of:

	Atoms.	*Weight.*	*Volume.*	
Oxygen,	2,	72.73,	1,	sp. gr. 1.528.
Carbon,	1,	27.27,	1,	

This gas, although containing a larger proportion of oxygen than atmospheric air, is still unsuited to the purposes of respiration. The oxygen which it contains, being chemically combined by complete combustion, is therefore incapable of entering into new combinations in the capillaries of the lungs, and of decarbonizing the blood. It does not seem to be directly poisonous, although animals die when

placed in it about as quickly as if placed under water, and in a very similar manner. There is this difference, however: an animal placed under water for a short time may be resuscitated after being removed from that fluid, but an animal being placed in carbonic acid, and having once inhaled that substance, is usually incapable of resuscitation. The reason probably is, that the specific gravity of carbonic acid being much greater than that of atmospheric air, it is consequently retained in the air-cells of the lungs; thus effectually preventing the ingress of air, and causing death by asphyxia. Even when largely diluted it is still capable of producing most noxious effects.

I have already stated that a small proportion of carbonic acid is everywhere found mingled with the atmosphere. This proportion is usually from three-tenths to four-tenths of one per cent. Whenever the proportion rises much above this the atmosphere becomes unwholesome. When it reaches even three per cent. it is wholly unfit for respiration. When it reaches five per cent. it is highly dangerous to life to breathe it even for a short time; and when its proportion is increased to eight or ten per cent. it becomes suddenly and certainly fatal.

The high specific gravity of this gas prevents its rapid dissipation, and renders it capable of being forced in a concentrated state, by air currents, in any direction, and to considerable distances. It must, therefore, become pretty generally diffused, in varying proportions, throughout our atmosphere. The effects produced by this gas in a pure, or in a concentrated, state are well understood; but the effects produced by it in its more diluted forms are probably not so well ascertained. It seems to exert its deleterious effects by preventing the due oxydation of the blood, and thus manifesting its morbific power in disturbances of the nervous system. Headache, vertigo, fainting, nausea, pains in the loins, lethargy, palpitation, &c., are generally mentioned as characteristic effects of its inhalation. The severity of these symptoms must, of course, depend upon the quanti-

ty inhaled, as well as upon the nervous susceptibility of the person afflicted. I have no means of estimating the amount or the proportion of this gas which is present in the air of this valley. It doubtless varies greatly with other varying conditions of the atmosphere. Its general tendency is to accumulate near the surface, and in the lowest spaces. But this tendency may be overcome by wind currents, by heat, and by the tendency which all gasses have of mixing together, or of diffusibility; and it may in this way become mingled with the atmosphere in more elevated locations. The amount of coal undergoing combustion about us is such as to indicate that an immense quantity of this gas is being constantly mixed with the atmosphere that we are required to breathe; such an amount, indeed, as must seriously interfere with the health and vigor of those who constantly respire it.

Another of the gases evolved by the combustion of anthracite coal, and the effects of which we have to consider, is sulphureted hydrogen. This is composed of:

	Atoms.	*Weight.*	*Volume.*	
Sulphur,	1,	94.15,	1-6,	sp. gr. 1.174.
Hydrogen,	1,	5.85,	1,	

This is an exceedingly active poison. Thenard states that atmospheric air which contains one-fifteen-hundredth part of its volume of this gas will destroy a bird; one-eight-hundredth part of it will destroy a dog, and one-two-hundredth-and-fiftieth part of it will kill a horse. Taylor, in his "Medical Jurisprudence," says, "Sulphureted hydrogen gas, when breathed in its pure state, is instantaneously fatal. It exerts equally deleterious effects upon all orders of animals and upon the textures of the body. It has been known to destroy life even when allowed to remain in contact with the skin." As this gas is generated by the combustion of coal, it is usually accompanied and mixed with sulphurous acid gas [S. O. 2]. The effects of each of these gases are very similar, both in respect to the symptoms which they present in the living, and in the lesions found,

as a result of their inhalation, on *post mortem* examination. The effects produced by these gases in a pure state, as well as in a state of moderate dilution, are also well understood. Works on medical jurisprudence abound in instances of death produced by them in a concentrated state, as well as of the *post mortem* appearances presented by their victims. In cases of fatal inhalation of these gases, the symptoms usually noticed are purple lips, lividity of countenance, surface of body cold, hands and nails purple, inspiration quick and short, pulse small, quick and feeble, pupils fixed, and total insensibility. The *post mortem* appearances usually observed, are congestion of membranes of brain, effusion of fluid under the arachnoid, sinuses gorged with blood, lungs congested, and right cavities of heart engorged. The consequences resulting from the inhalation of these gases, in their more dilute form, must vary in their intensity, as well as in the character of the symptoms produced, according to the amount inhaled, the proportion of the noxious materials, as compared with the respired air, the vigor and susceptibility of the person affected. The results in these cases of slow, constant and partial poisoning have not been studied with the care and precision which their importance demands, and I apprehend that their damaging effects upon public health are not adequately understood and appreciated even by the medical profession. As an illustration of the powerful effects of these gases upon the lower forms of life, I may mention that, during a period of thirty years which I have practiced medicine in this valley, I have never once seen a case of psora, or itch, which originated within our anthracite coal field; nor have I seen one which, having been brought here, did not speedily recover, without medical treatment. This disease, as is well known, is produced by a minute insect, which burrows in the skin. Sulphurous gases have long been known as an efficient remedy for this disease. It is evident that our atmosphere contains a sufficient amount of these gases to effectually destroy this insect. This is one of the compensations which we enjoy

for being compelled to respire an unwholesome atmosphere; but it forcibly illustrates the important changes that may be wrought within our bodies by agents whose presence, or even whose existence, is unsuspected.

Another contaminating ingredient of our atmosphere, which is engendered by the combustion of coal, is carbonic oxide. It is composed of:

	Atoms.	*Weight.*	*Volume.*	
Oxygen,	1,	56.69,	1-2,	sp. gr. 9.75.
Carbon,	1,	43.31,	1,	

We have already seen that carbonic acid consists of one atom of oxygen and two of carbon. Carbonic oxide contains one atom of oxygen and one of carbon. In its formation, therefore, but one-half as much oxygen is abstracted from the atmosphere as in the former, but its effect in vitiating the air is far greater than that of carbonic acid. Carbonic acid, as we have seen, exercises its deadly power by choking or obstructing the air cells of the lungs, and preventing the ingress of oxygen. Carbonic oxide is a deadly and rapid narcotic poison. An atmosphere containing only one per cent. of this gas will destroy life in a few minutes, and in its pure state it is almost instantaneously fatal. It passes rapidly into the blood. In an animal which inhaled air containing ten per cent. of this substance for thirty seconds, the blood was found to contain four per cent. of carbonic oxide, and a diminished proportion of oxygen. The blood is brightened in color by its inhalation, as it is darkened by the effects of carbonic acid. This bright color is very permanent. It has been observed to continue for three weeks in animals which had been subjected to its influence. Its mode of action is supposed to be the reverse of that of carbonic acid—that is, it produces its poisonous effects by preventing the arterial blood from becoming venous, while carbonic acid poisons by preventing the venous blood from becoming arterial. In animals that have died from the effects of this gas in a diluted state, there has been observed an engorgement of the muscles of

the heart, a congested state of the brain, and an anaemic condition of the spleen. But when life has been destroyed by the inhalation of this substance in a pure state, death has ensued so rapidly that very few *post mortem* appearances were produced. This gas is generated, like carbonic acid, by the combustion of coal, or the oxydation of carbon. It, however, is the product of an incomplete combustion, and the oxygen concerned in its production is only half as great, in proportion to the carbon entering into the combination, as in the case of carbonic acid. The slow combustion constantly going on in the culm heaps would seem to be especially favorable to the formation of this gas. This combustion goes on, for the greatest part, with but a very limited amount of oxygen; and much of it takes place under circumstances which admit of only the smallest supply of oxygen that renders combustion possible. Wherever the air has free access to the burning materials, carbonic acid, as well as sulphurous acid and carbureted hydrogen, are produced; but in a slow and imperfect combustion, where the temperature becomes high, and where atmospheric air finds limited access, as in the interior of a burning culm pile, carbonic oxide and sulphureted hydrogen are evolved in the greatest abundance. Thus it will be seen that the combustion, which is so extensively going on in the culm heaps all around us, furnishes just the conditions which are most favorable for the evolution of the greatest quantity of noxious gases, as well as of gases of the most noxious kinds, that the combustion of coal is capable of producing.

In addition to the contaminating agencies contained in our atmosphere that I have already described, there are other products of decomposing materials about the air of our city which should not be overlooked when investigating the sources of our epidemic diseases. We have, within a limited area, a population of considerably more than twenty thousand. We have a flat and even surface, with little natural drainage, and that little, for the most part, artificially obstructed. We have had, until very recently,

an almost entire absence of sewerage, and we still have only a very limited extent of it. The few sewers which have thus far been constructed discharge their contents on the margin of the river, in close proximity to the most populous portion of the town, leaving their decomposing materials to generate foetid and noxious gases along the entire river front of the city—polluting alike earth, air and water along its whole extent. But by far the larger portion of our city has not, and never has had, any sewerage whatever. Contained within the soil, in old wells, and in cess-pools, and in some places festering upon the surface, is the accumulated filth and nastiness of a century—a century of neglect, indifference to, and defiance of natural sanitary laws. Far less neglect of sanitary measures than is here seen has spread death and desolation through many a town and city. In view of the persistent and reckless neglect on the part of our inhabitants, or our authorities, to provide for the protection of their health or the prevention of disease, it seems the *imperative duty* of the medical profession to urge and to insist upon the adoption and the speedy execution of some efficient measures for the purification of our city. In the light of the history and experience of other cities, it seems strange that the people of Wilkes-Barre have hitherto escaped the penalties and the pestilence which persistent neglect of sanitary laws must sooner or later engender. It is criminal folly to attempt to ignore the fact that the atmosphere we are breathing is largely made up of materials that are highly injurious to health, that were never designed for respiration, and that the great quantities of carbonic and sulphurous gases that are constantly being mixed with the air around us, which proper prudence can greatly diminish, together with the exhalations of the immense amount of decomposing matter, which can be, and long ago should have been, removed and rendered innocuous, must necessarily produce, and does produce, an atmosphere better suited to the respiratory requirements of the

extinct saurians of the carboniferous age, than for the respiration of human beings.

I regret, as much as any one can, the occasion and the necessity that exist for the utterance of such observations as I have made. We of the medical profession will, no doubt, profit pecuniarily by the continuance of the state of things which I have described. But it is our *duty* to view these things just as they are, and whether it be agreeable or not, to tell the people of this town what must be the consequence of a further neglect of some general and efficient sanitary regulations. It is high time that a thorough system of drainage and sewerage was adopted which will carry away the refuse of our city, and render the air about us incapable of contamination from such a source. It is high time, too, that measures were taken to prevent the accumulation of culm in the vicinity of our city, and especially within its boundaries. The present system of its disposal is a shameful waste. The world needs, and at no distant day will need still more, every pound of that material which is now made to subserve no better purpose than to poison our atmosphere and destroy our health

I have thus passed in rapid review what seem the most apparent, tangible, and obvious sources of malarial diseases which exist in this locality. We have seen that some of these gases, which are always abundant in our atmosphere, are directly destructive to the tissues of the body, as well as to the corpuscles of the blood. Their presence in the atmosphere, therefore, in any proportion, must necessarily render it more or less unfit for respiration. The effects of its inhalation must in all cases be damaging—varying in degree, not in kind, between the mildest and the severest consequences that it is capable of producing. All agree that there is a general prevalence of some atmospheric influence in this vicinity which depresses vitality and engenders disease. During the entire year—whether it be wet or dry, hot or cold—there is a general and a constant complaint of "*malaria*." The "epizootic" in its day, or the "Tyler gripe,"

was not more universal in its sway than is this prevailing influence which everybody feels or fancies, and designates "malaria." I have no doubt that this term has often been used indiscriminately to designate ills which have but little connection with atmospheric influence. It has become with us a fashion, or a habit, to attribute every ill-feeling to this rather indefinite source. Intemperance, gluttony, exposure, dissipation and excesses of every kind produce everywhere a prolific brood of physical and mental ills, from which our population is by no means exempt. All these are usually called by anything but their proper name, and find a convenient receptacle in this general but rather indefinite term—this general diagnostic dumping ground—"*malaria*."

There is, however, a numerous class of diseases prevailing in our vicinity which doubtless *have* their sources in the atmospheric poisons of which I have spoken. It is quite uncommon to meet with a resident of this city who will tell you that he feels thoroughly and uniformly well. He will usually tell you that he feels an unwonted degree of oppression or of languor; that he has backache, headache, neuralgia, nervous irritability, capricious appetite, impaired digestion; that he is peculiarly sensitive to cold, or that he has slight chills; in short, that he has "*the malaria*," and that he has been taking quinine. He will also tell you that he always feels better when away from home; that even a short residence elsewhere always improves his condition, and that the beneficial effects of even a few hours' respiration of the pure air of our mountains are plainly and unmistakably felt by him; but that his former symptoms are again gradually but surely developed by a return to this locality. Are the symptoms so generally felt and complained of in our vicinity, which I have here enumerated, as well as the more severe forms of our endemic diseases, produced by the same agents or poisons which produce the malarial diseases of other localities? Or, are they engendered by the adulteration of our atmosphere with the noxious gases which are produced

by the peculiar conditions which surround us? Do the endemic diseases of our locality, usually termed "malarial," differ essentially in their sources, in their symptoms, in respect to the remedial agents best adapted to their cure, from the malarial diseases of other regions? I believe that in most respects, and in by far the largest number of instances, they do. My reasons for this belief, briefly stated, are these:

1st. Miasmatic fevers usually prevail only in summer and autumn. A freezing temperature generally puts an end to them. *Our* malarial diseases occur at all seasons; indeed, we are never exempt from them. They are often most prevalent in cold weather, toward the end of winter or in early spring—the very seasons when ordinary marsh miasm must necessarily be most inactive.

2d. Diseases produced by marsh miasmata are usually strictly periodical in their occurrence, except in their more severe forms—and even then they often evince a tendency to periodicity—that is, miasmatic diseases (as generally seen) present intervals of comparative health, followed by a regular succession of chills, fever and sweating, with an indefinite recurrence of the same symptoms on successive or alternate days. Such recurrence is seldom seen in this locality; a complete subsidence of the fever usually terminates the attack.

3d. The disturbances induced by *our* malaria, in the milder class of cases, speedily disappear without medication when the person affected is removed to a pure atmosphere. This change takes place much more slowly when sickness is induced by marsh miasmata.

4th. The ordinary causes which produce marsh miasm exist to only a very limited extent in this vicinity. Most of those moist, low places where miasm may once have been evolved are now covered by burning culm piles, or flooded by mine water, in either case effectually preventing the growth of cryptogamic or other vegetation, thus preventing the production of ordinary marsh miasm.

5th. The symptoms presented by our endemic diseases, while differing in the respects just stated from ordinary miasmatic disease, are such as usually result from the inhalation of the gases evolved by the combustion of coal.

6th. The particular periods when the manifestations of our endemic diseases are most marked, are during damp, still, foggy weather, when these gases accumulate in large quantity and in concentrated form The periods when we are most exempt from them are during and immediately succeeding brisk winds—by which these gases are speedily dissipated or carried away.

7th. There are still some marshy grounds within the boundaries of our valley, which have not yet been flooded with mine water, nor covered with culm, where marsh miasm is probably generated, and where that class of diseases, which is always produced by it, may yet prevail; but the area of such territory is so limited that its effects can scarcely be general.

I have no doubt that cases of miasmatic fever, or fever and ague, as well as its more intense forms, occur in this city. I believe I occasionally see such. I see many cases which I can trace to a different source—which have had their origin in carbonic and sulphurous gases—to the treatment of which quinine seems well adapted. But this is by no means conclusive proof, nor the slightest evidence, that the two diseases have a common origin or a common character. Both these malarial influences are, apparently, sometimes combined in their production.

In the more thickly populated portions of the valley, but especially in the city of Wilkes-Barre, endemic diseases, while deriving their principal causes and acquiring their chief characteristics from the gases of coal, are yet greatly modified or intensified by the commingling of other poisons —both gaseous and liquid—with these. The vile odors that assail our olfactories in nearly every portion of the city, emanating from filthy streets, from stagnant gutters, and from festering pools, greatly intensify and often strangely

complicate the symptoms of these diseases. A prolific brood of fatal maladies may be engendered by these causes alone. These filthy exhalations certainly contaminate our atmosphere in a manner and to a degree that is alike disgusting, dangerous, and disgraceful, and no doubt often make it exceedingly difficult to determine just what is the remote or the proximate cause of a particular case of disease.

In most cities, and I believe to some extent in our own, the gases that are generated in *sewers* sometimes become a means of vitiating the atmosphere and a consequent source of disease. The evolution of gases in sewers is probably an unavoidable incident with all systems of sewerage. These are exceedingly complex in their composition, owing to the great variety of decomposable substances which find their way into the sewers of a large town. The most noxious of these effluvia, however, and those which most extensively and most injuriously affect health, are sulphureted hydrogen and sulphide of ammonium. The latter, like the more damaging gases evolved by the conbustion of coal, is produced in the absence of, or in the presence of, only a very small quantity of oxygen. The few sewers which we have —I mean those constructed for public use—being of large size, and admitting a large amount of atmospheric air, do not engender the most offensive nor the most dangerous gases that may be produced in sewers. Still, imperfect plumbing and carelessness and unskillfulness in building, often, I apprehend—certainly sometimes—lead to the complete permeation of dwellings by the gases from sewers, with more or less injurious effects upon those who respire them. A careful and thorough supervision should be exercised by our city authorities over the construction of all dwellings, and every precaution that prudence can devise should be enforced in guarding against the possible production of disease from such sources.

The very limited extent to which sewers of any kind have been constructed in Wilkes-Barre renders it improbable that the air of our city is appreciably affected by sewer gases, except

in the immediate vicinity of the sewers. There is a good reason, however, for believing that some of the *small*, close, and unventilated private sewers about our city, have been, and are still, a frequent source of disease. I understand that a very severe case of malarial disease has recently occurred in the family of one of our members which was clearly traceable to this cause. How many other cases of disease and of death in our city, originating in a similar source, have been unjustly charged upon Divine Providence, we can only conjecture.

The same damaging effects upon health which are so extensively caused by the burning of culm, are often produced on a more limited scale, but with even greater intensity, by neglected or imperfect appliances for the warming of dwellings, or in the use of coal for other domestic purposes. Instances of suffocation and of death from these causes occasionally occur. Cases of pneumonia, of bronchitis, of neuralgia, of chills and fever, originating in this manner, and of greater or less gravity, are, I believe, far more numerous than is generally supposed, not only in this vicinity, but wherever anthracite coal is consumed as fuel. The frequent complaints of malarial diseases that are heard in many of the larger towns and cities of our country, where marsh misam is certainly not prevalent, but where anthracite coal is extensively used, are probably to a great extent due to the same carbonic and sulphurous gases that so seriously impair the healthfulness of this region.

In many portions of Wyoming Valley the springs and wells which formerly supplied the inhabitants with an abundant supply of pure and wholesome water, have been rendered dry by the operations of mining, and the inhabitants have consequently been compelled to obtain their water supply from adjacent streams, or from reservoirs supplied by pumping water from the Susquehanna river. The city of Wilkes-Barre receives a partial supply of tolerably pure water, during the greater portion of the year, from one of the mountain streams. Plymouth obtains a much smaller

and less adequate supply from a similar source. With these exceptions, the water which the inhabitants of this valley use, is, as a rule, exceedingly impure and unwholesome.

Wherever mining operations are carried on, springs and wells in that vicinity are effectually drained, and the mineral tinctured water of the mines is poured into the adjacent water courses. These streams, often running through a densely populated neighborhood, generally become the receptacles of whatever is foul, disagreeable and unwholesome, and carry their impurities into the Susquehanna. To what extent these streams have furnished a direct water supply to our population I am unable to say; but the inhabitants of some of our larger towns have consumed these impurities in by no means homœopathic doses. The populous town of Pittston derives its water supply from the Susquehanna at a short distance below the point where the Lackawanna river pours into it a current of water so foul and poisonous that no living creature—not a fish, not even a reptile, can exist in it. Wilkes-Barre, during the hottest and driest portion of the year, is compelled to obtain a large proportion of the water it consumes from a similar source. Plymouth, in addition to the *richness* imparted to the water of the Susquehanna by Mill Creek, Toby's and other tributary streams of impurity, has the benefit of whatever filth is emptied into the former river by the sewers of Wilkes-Barre, and which is not retained along our city front for the purposes of perfuming our own atmosphere. Just what that substance is that by courtesy is called "water," in the vicinity of Nanticoke, I am not able to state; but, judging from the cadaverous looks of most of the inhabitants of that place, I should incline to the opinion that it is not very largely adulterated with *aqua pura.*

With two of the elements so essential to human existence as *air* and *water* thus rendered impure and unwholesome, and made the media for conveying into our systems the agents and the germs of disease, it is by no means surprising that such an amount of "*indigenous malarial disease*" has for

years prevailed about us as to have given to our valley the reputation of being an excellent place to migrate from; nor is it to be wondered at that its physicians should all have attained the reputation of being practitioners of *large experience.*

In regard to the medical treatment of diseases which are the consequences of the atmospheric conditions which I have described, I am unable to lay down any general, much less any specific, rules. In the milder class of cases, simple removal to a pure atmophere is all that is required. To those who must remain and continue to inhale the poisons from which they are already suffering, tonics and stimulants usually afford at least an alleviation of the symptoms. Quinine, especially, seems to afford a ready method of alleviating discomfort for a time, but in the more severe cases of coal-gas poisoning, it seems altogether incapable of effecting a cure. The chills and fever, with their concomitant symptoms, run on, sometimes to a fatal termination, in spite of the usual anti-periodic remedies. In these severe forms of our endemic diseases, in view of the altered or deoxydized condition of the blood corpuscles known to be produced by carbonic oxide, I have been accustomed to administer chlorate of potassa in conjunction with muriated tincture of iron and quinine. This treatment, upon theoretical grounds at least, would seem to furnish the most practical method for counteracting the poisonous effects of the gas, by restoring the integrity of the blood corpuscles and sustaining the vigor of the nervous system. These are important indications to be fulfilled in all cases of pure, uncomplicated fever. But, as I have already stated, our endemic diseases are the results of such complex causes, and present such a variety of symptoms, that no specific rules can be adopted for their management. Each case must be investigated by itself, and treated according to the characteristics which it presents and the lesions which exist, by whatever methods most commend themselves to the intelligence, the judgment, and the experience of the physician to whose care it is consigned.